STUDIES ON MARINE BRYOZOA. I. AEVERRILLIA SETIGERA (HINCKS) 1887

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Introduction

During the summer of 1944 collections of *Aeverrillia setigera* were made at New Bedford and Woods Hole, Massachusetts. Perusal of literature pertaining to this species showed that a more complete account of this form would not be amiss. This article brings together all available distribution and anatomical data previously given for this form and adds to it some new distribution data, more complete illustrations than were heretofore available and a considerable amount of anatomical and some ecological data.

The writer wishes to acknowledge, with sincere appreciation, the kindness of Dr. Hannah Croasdale of Dartmouth College and of the Marine Biological Laboratory of Woods Hole, Mass., who collected the first specimens of *A. setigera* from New Bedford, Mass., and turned them over to the writer for study, and to Dr. Raymond C. Osburn of the University of Southern California who so kindly checked the specimens, confirming the identification and who offered many helpful suggestions.

Distribution

The species *Buskia setigera* has been reported previously by the following authorities from the localities listed below:

Hincks, 1887 (pp. 121, 127-128; Pl. XII, Figs. 9-13), from the Gulf of Bengal, around the Mergui Archipelago.

Kirkpatrick, 1890a (pp. 603, 612), between Australia and New Guinea in the Torres Straits, 20 miles off Warrior Island.

Kirkpatrick, 1890b (p. 17), off Tizard Banks in the China Sea.

Thornely, 1905 (p. 128), from Ceylon.

Harmer, 1915 (pp. 87-88; Pl. 5, Figs. 8-10), from the Bay of Bima (India), Bay of Badjo, west coast of Flores (Malay Archipelago), Makassar, Borneo Bank, off Pulu Jedan, east coast of Aru Islands, and also in the following unnamed locations: Station 164, at 1°42′.5 S.; 130°47′.5 E.; Station 166, at 2°28′.5 S.; 131°3′.3 E.

Thornely, 1916, off Poshetra Head, Kattiawar, and Ceylon.

Hastings, 1927 (p. 351), at Menzaleh Lock and other stations at the Suez Canal.

Livingstone, 1927 (p. 67), from Queensland, Australia.

Hastings, 1932 (p. 407), from Penguin Channel and N. E. Low Island, Great Barrier Reef, Australia.

Osburn, 1933 (p. 64), from Porto Rico.

Marcus, 1937 (p. 143; Pl. 29, Fig. 76), from Bay of Santos, Brazil, South America.

Osburn, 1940 (p. 343), from Porto Rico.

Hutchins, 1945 (p. 539), Pine Orchard, Long Island Sound, Connecticut, U.S.A.

Additional discussion of the species occurs in the following articles:

Osburn and Veth, 1922; (p. 159).

Marcus, 1938; (p. 61).

Marcus, 1939; (pp. 168, 171).

Marcus, 1941; (pp. 74-77, 147; Pl. X, Fig. 45).

The above reports indicate that the species is distributed near several continents, —Africa (Suez Canal), Asia, Australia, South America, and North America, and also around several islands, including Porto Rico. The present article reports its occurrence around the State of Massachusetts, extending the northerly range of this species to 41°38′ N. Latitude.

Averrillia setigera was found in two Massachusetts localities. The first collection was made by Dr. Hannah Croasdale on July 29, 1944, at Black Rock in the Harbor of New Bedford, Mass. The next collections were made by the author on August 4, 13, and 14, 1944, at Stony Beach, Woods Hole, Mass. Further details of the nature of the collecting site and the associated biota will be given in the ECOLOGY section.

Ecology

The New Bedford Harbor specimens were collected by Dr. Croasdale at the time of low tide, from the littorine region around Black Rock, along with red algae, at a depth of less than 2 feet below the surface of the water. The Woods Hole specimens came from a large, partially submerged boulder located approximately 50 yards from shore. The sea bottom around the boulder is largely sand although there are some rocks a short distance away on each side of the boulder. The general locality is not subjected to strong wave action. The boulder is almost completely submerged at high tide but is about half exposed at low tide. Its sides are well covered with algae of various kinds as well as with a luxuriant fauna. The *A. setigera* colonies were collected at low tide, a foot or two below water level, by gathering likely looking *Chondrus* and *Ascophyllum* algae off the boulder.

The Woods Hole *A. setigera* specimens were found growing in close association with the following animal forms: *Folliculina, Vorticella, Sycon, Obelia, Sertularia,* other hydroids, *Bowerbankia gracilis, Bugula flabellata, Crisia eburnea,* *Hippothoa hyalina, Pedicellina cernua,* and *Stephanosella biaperta.* The *Aeverrillia* autozoids, and in some instances stolons, had a few *Folliculina, Vorticella,* or *Pedicellina,* growing on them. The *A. setigera* colonies grew on hydroid stems and on the same algal thalli (*Chondrus* and *Ascophyllum*) as *Bugula flabellata, Hippothoa hyalina, Crisia,* and the other Bryozoa.

Aeverrillia setigera has been collected from varying depths, from one or two feet below tide mark (present author) to much greater depths (other writers). Kirkpatrick found specimens at depths of 5½ and 27 fathoms; Thornely (1916), at 7 fathoms; Hastings (1932), at 8 to 15½ fathoms; Marcus (1937), at 17 meters; while Harmer found specimens at greater depths: 0 to 40 meters, 55 meters, 59 meters and 118 meters.

This Bryozoan grows on the following types of substratum: 1, on broken shells (Kirkpatrick, 1890a); 2, on stems of *Idia pristis* (Thornely, 1916); 3, on stems of hydroids and Bryozoa (Osburn, 1940); 4, on stems of *Nellia oculata* Busk (Hincks, 1887); 5, on hydroids and the following Bryozoa: *Bugula, Catenicella* and *Valkeria atlantica,* which were dredged from areas whose bottom consisted of such materials as mud, sand, hard coarse sand, coral, shells, and stones (Harmer, 1915); and 6, on hydroids like *Obelia* and algae like *Chondrus* and *Ascophyllum,* in close association with many other already mentioned animal forms (present paper).

Description of Species

The status of Bryozoa as an entire group is still an unsettled problem. It has been considered a Phylum, a Sub-phylum and a Class. Each category has its earnest and qualified supporters. With this in mind the following taxonomy of the *Aeverrillia* species, patterned after the work of Dr. Marcus, is given:

——— BRYOZOA Ehrenberg 1831
Class ECTOPROCTA Nitsche 1869
Order GYMNOLAEMATA Allman 1856
Sub-order CTENOSTOMATA Busk 1852
Group STOLONIFERA Ehlers 1876
Family Valkeriidae or Mimosellidae?
Genus *Aeverrillia* Marcus 1941
Species *setigera* Hincks 1887

The classification of *Aeverrillia setigera* has undergone a few changes since its original description by Hincks in 1887. Its generic names were *Buskia, Hippuraria,* and now *Aeverrillia.* The latter genus was erected in 1941 by Dr. Marcus in honor of A. E. Verrill.

The question regarding the family into which it should be placed is set forth by Marcus (1941, p. 147) thus: "*Aeverrillia* does not need a new family; the genus can be placed in the Valkeriidae or perhaps in the Mimosellidae as now enlarged by Bassler (1935, p. 8)." Earlier the species had been placed among the Triticellidae, the Buskiidae, and eventually into the Valkeriidae.

The colonies are delicate yellowish or very pale amber colored transparent traceries closely adherent to various living and non-living submerged objects. They are barely big enough to be seen with the unaided eye. They consist of paired individuals connected by slender stolons. The stolons and individuals are chitinized and firm-walled. The stolons especially have a well thickened wall.

Bryozoa exhibit polymorphism. The *Aeverrillia* colony consists of three types of structures or possibly individuals, namely stolons, peduncles, and autozoids.

In the colony there is a main or primary axis or stolon and lesser (secondary and sometimes tertiary) stolons (Fig. 7). The lesser stolons are more apparent in older colonies than in young ones.

These stolons, according to Dr. Marcus, are composed of kenozooecia. The long slender tubular kenozooecia of each stolon grow longitudinally and are attached end to end. Those of the secondary stolons have their origin at the sides of the primary stolon usually with a peduncle intervening between the primary and secondary stolons. The tertiaries have their origin at the sides of the secondaries, likewise usually with an intervening peduncle. Some stolons appear to arise directly from other stolons without an intervening peduncle (Fig. 8). Also, one of a pair of opposite stolons may arise from a stolon without the intervention of a peduncle while its partner may have a peduncle between it and its parent stolon (Fig. 8). Whether this barrenness of one stolon may be a temporary or a permanent condition is uncertain.

The primary and secondary stolons are at right angles, approximately, to each other but it is difficult to say the same about the tertiaries because the latter are sometimes twisted, gnarled, and not often found running in a straight line because of the limited area of the substratum on which the specimens grow. The secondary stolons usually originate in pairs, one stolon on each side of the primary stolon and directly opposite the other, growing away from each other.

The primary stolons, possibly because they are older, have thicker walls than the secondary stolons. The primaries are also somewhat straighter than the secondary and tertiary stolons but that again may be due to the limited substratum. Anastomoses occur occasionally, especially where there are tertiary and secondary stolons over a crowded or limited substratum. Hincks suggested the possibility of anastomosis of branches.

Primary stolons are very closely and entirely adherent to the substratum which in many cases proves to be a hydroid stem or *Chondrus* or *Ascophyllum* thallus. The primaries follow the stems or thalli in a fairly straight line for some distance. The secondaries and tertiaries must find what surface they can. Some of the lesser stolons look as if they are not necessarily attached along their entire length.

Generally the kenozooecia of the stolons are slightly enlarged distally at the point of origin of the lateral kenozooecia or peduncles. Transverse uniporous septa mark the proximal and distal limits of the kenozooecia along the stolons (Figs. 2 and 10). There are septa also at the points of origin of the lateral branches on the main stolons (Figs. 16 and 18). The region of the septum is sometimes referred to as the node and the stretch of stolon between two transverse septa, as the internode.

Stolon length is variable (Figs. 7 and 9, Table I). Some secondary stolons are short, some long. Some tertiary stolons are considerably longer than the primaries or than some of the secondaries. Stolon diameter is given in Table I.

The stolons under low power observation (75 × magnification) appear empty or tubular but under higher magnification (430 ×) a cellular lining membrane is evident within them.

TABLE I

Measurements of Massachusetts specimens of Aeverrillia setigera

Part	Number of readings	Maximum	Minimum	Average	Refer to Figs.
A. Length or height of furled setigerous collar	17	0.602 mm.	0.440 mm.	0.531 mm.	6, 17
B. Diameter at distal end of unfurled setigerous collar	5	0.537 mm.	0.370 mm.	0.440 mm.	6
C. Diameter at the basal, proximal end of the setigerous collar	6	0.110 mm.	0.059 mm.	0.083 mm.	6, 17
D. Length of orificial spine	20	0.259 mm.	0.141 mm.	0.204 mm.	6
E. Diameter of extruded vestibular membrane	1			0.111 mm.	6
F. Length of extruded vestibular membrane	1			0.321 mm.	6
G. Length of tentacular sheath	1			0.237 mm.	6
H. Diameter of tentacular sheath	2	0.096 mm.	0.074 mm.	0.085 mm.	6, 11
I. Autozoid width at widest part	7	0.212 mm.	0.170 mm.	0.185 mm.	8
J. Autozoid length from base of zoid to base of orificial spines	18	0.592 mm.	0.481 mm.	0.552 mm.	8
K. Stolon diameter, at the normal thickness, not the swollen area of the stolon	24	0.049 mm.	0.015 mm.	0.027 mm.	8
La. Length of shorter lateral surface of the clasping processes	23	0.179 mm.	0.043 mm.	0.110 mm.	7
Lb. Length of longer lateral surface of the clasping processes	23	0.182 mm.	0.077 mm.	0.119 mm.	7
M. Width of stolon at most swollen part, near node	18	0.051 mm.	0.034 mm.	0.040 mm.	8
N. Length of peduncle	19	0.170 mm.	0.068 mm.	0.114 mm.	18
O. Diameter of peduncle	19	0.071 mm.	0.039 mm.	0.058 mm.	8
P. Length of internode	24	1.013 mm.	0.294 mm.	0.658 mm.	9
S. Number of tentacles	6	8	8	8	6, 13, 14
T. Number of setae in setigerous collar	3	19	16	17	6

PLATE I

All figures except Figures 2 and 6 have been drawn with the aid of a camera lucida. All are of *Aeverrillia setigera.*

FIGURE 1. A chitinized sconce of the proventriculus, seen from the lumen side. Note the converging rows of teeth. Drawn to the same scale as Figure 10. This and Figures 3, 4, and 5 are from gizzard remains found in empty, degenerated autozooecia.

FIGURE 2. Detail of the uniporous septum which occurs along the stolons.

FIGURE 3. Latero-basal view, from the concave side of the chitinized gizzard sconce. All the softer parts of the gizzard have disintegrated, leaving only the hardened plate or sconce. Drawn to the same scale as Figure 10.

FIGURE 4. Side view of a somewhat flattened chitinized gizzard sconce. Drawn to the same scale as Figure 10.

FIGURE 5. Side view of a chitinized gizzard sconce of the more usual shape. Some of the teeth are darker than others. Drawn to the same scale as Figure 10.

FIGURE 6. A diagram showing several things: the relation between the open or unfurled setigerous collar, the eight tentacles, three of the four zooecial spines around the orifice and the lettered areas A through G along which measurements for Table I have been made. The same letters are found listed in the first column of the Table.

Line A stands for the length or height of the setigerous collar. It was measured only when furled or very slightly unfurled.

Line B represents the diameter of an unfurled setigerous collar, at its distal, expanded end.

Line C represents the diameter at the basal or proximal end of the setigerous collar.

Line D represents the length of the orificial spine.

Line E represents the diameter of the vestibular membrane and the area it encloses.

Line F represents the length of the vestibular membrane.

Line G represents the length of the tentacular sheath or the distance between the lophophore and the base of the setigerous collar, C——C.

FIGURE 7. Part of an old zoarium or colony showing the growth habit, anastomosis of branches (AN), primary stolon (P.ST.) and secondary stolon (S.ST.). All the autozooecia are empty of polypides. One (Z) has the setigerous collar in place yet but has no polypide. Some of the zooecia have two or three acuminate processes (B.P.). Measurements of these acuminate processes were made along two surfaces, the shorter (La) and the longer (Lb). These figures are to be found in Table I. The "membranous" area mentioned by Hincks is not very plain on most specimens. However, there is a hint of it in the second and fourth zooecia from the top. Drawn from freshly collected material on Aug. 14, 1944, and to the scale shown at its base.

FIGURE 8. An autozooecium attached to a very long secondary stolon. The location of certain measurements mentioned in Table I is indicated on the drawing.

Line I represents the diameter of the autozoid.

Line J represents the length or height of the autozoid exclusive of spines.

Line K represents the diameter of the stolon along most of its length and not at the swollen areas.

Line M represents the diameter of the stolon at the slightly swollen node region.

Line O represents the height or thickness of the peduncle.

The faintly curving line along the autozooecium suggests the location of the "membranous" area. The scale below belongs with this sketch.

FIGURE 9. Part of a colony showing four autozoids growing quite regularly in pairs, on peduncles at opposite sides of the primary stolon. Two are empty, the third has a setigerous collar and the fourth has a living polypide within. A darker gizzard is evident within the last. The scale directly below belongs to this colony.

FIGURE 10. The section of the stolon showing a septum and the swollen part represented by M in Figure 8. This is the region of the node. Drawn to the scale directly below. Figures 1, 3, 4, 5, and 11 also are drawn to this scale.

FIGURE 11. Part of an autozoid showing the basal region of the setigerous collar through which is lightly indicated the tentacle-bearing lophophore and tentacular sheath. At the base of the setigerous collar are placed two small letters H which represent the width of the tentacular sheath. The measurements are found in Table I. Below the setigerous collar is the vestibular membrane through which are visible muscle fibers. Drawn to the same scale as Figure 10.

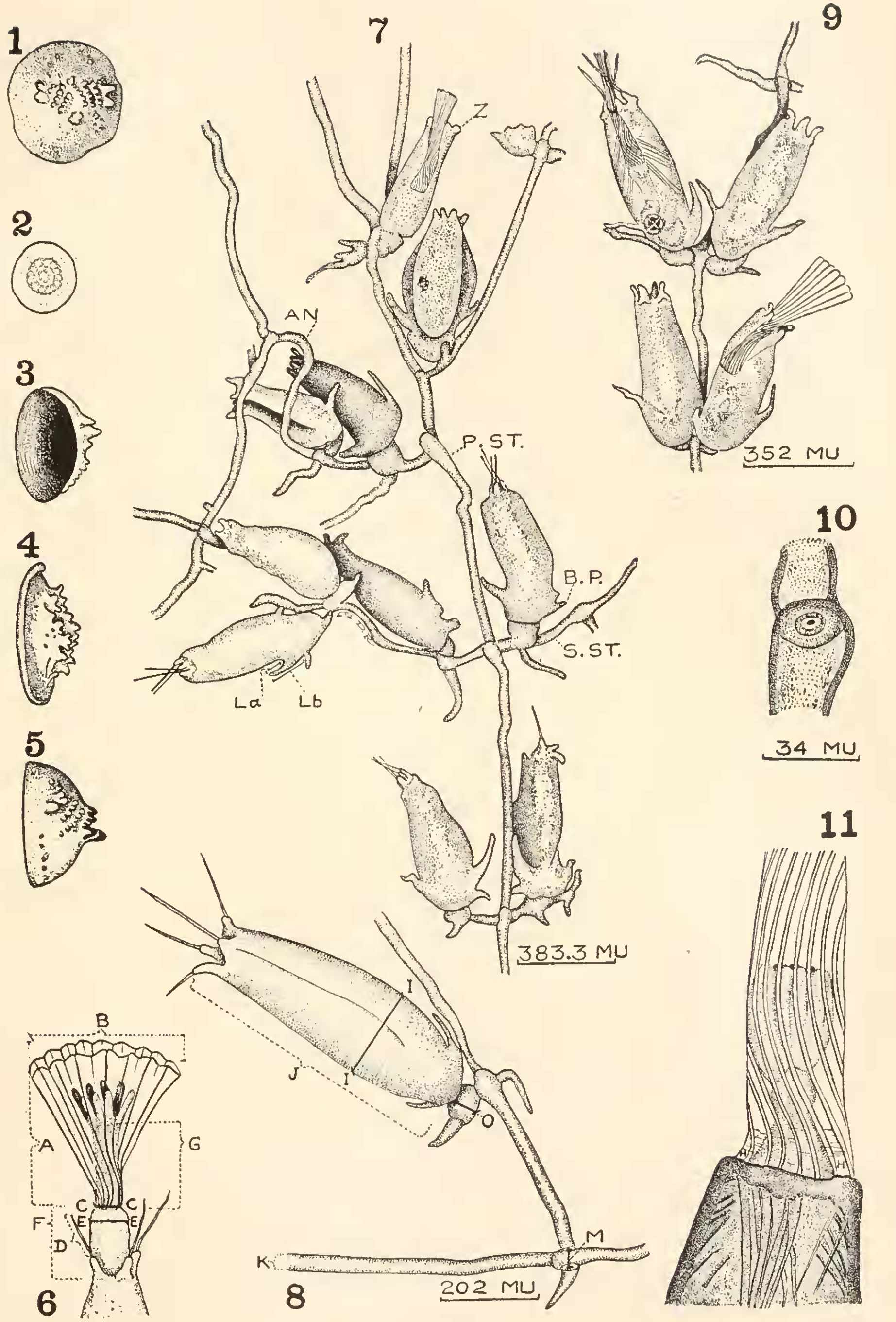
1
2
3
4
5
6
7
8
9
10
11
Z
AN
P. ST.
B. P.
S. ST.
La
Lb
383.3 MU
352 MU
34 MU
B
A
G
C
C
E
E
F
D
I
I
J
O
K
M
202 MU
H
H

PLATE I

The second type of structure or possibly individual (?) in *A. setigera* is the peduncle, so designated by Marcus (1937, p. 142). This is a short much swollen segment generally placed between stolons which are at right angles to each other and found at the base of the autozoids (Figs. 8 and 16). It originates from a stolon and gives rise to a stolon and an autozoid. It is cut off from the stolons and autozoid by a uniporous septum. A peduncle is more swollen and of shorter length than the stolon kenozooecium and has a lining membrane. In one instance there appeared a few transverse fibers inside a peduncle.

The third type of individual in an *A. setigera* colony is the autozoid. It arises from the peduncle. The autozoids are just big enough to see with the unaided eye. Harmer (1915, p. 87) gave their length as 0.48–0.55 mm. and Osburn (1940, p. 343) as 0.50–0.60 mm. Their width was given as 0.18 mm. (Harmer, 1915 and Osburn, 1940). Measurements of the Massachusetts specimens are given in Table I.

The autozoids occur in pairs bilaterally placed with respect to the primary stolon (Fig. 9). Where secondary stolons are well developed the autozoids occur in the same manner along the secondary stolon. Occasionally one of the paired autozoids is missing but a stub of its peduncle or a stolon may be present in its place (Fig. 8). These paired autozoids are not truly parallel but converge slightly basally as shown

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PLATE II

All figures are drawn with the aid of a camera lucida and are of *Aeverrillia setigera*.

FIGURE 12. A part of the unfurled setigerous collar, showing the delicate transparent membrane which folds like a fan. Its stiff supporting ribs or setae are transparent also. Drawn to the scale at left.

FIGURE 13. An autozoid in which a very young polypide is growing. A characteristic setigerous collar is not yet present although its Anlage (SC) is visible. Eight tentacles can be counted. The digestive tract is small. A gizzard or proventriculus is present in it. Drawn from living material on August 13, 1944, to the scale shown directly below.

FIGURE 14. Another young autozoid but slightly older than that of the preceding figure. Drawn to the same scale.

FIGURE 15. View of a mature autozoid showing an almost completely retracted polypide, a very long folded setigerous collar partially withdrawn, the U-shaped digestive tract twisted around in the lower half of the zooecium. The gizzard (GZ) is oriented in such a manner that one is looking along its vertical axis. Some of the body wall and polypide musculature is shown, particularly the circularly arranged parietal muscles (PM). The acuminate process is barely visible. Drawn to the same scale as Figure 12.

FIGURE 16. A partly retracted autozoid. The tentacle tips are just barely visible in the dark mass at the base of the spine-bearing processes. The somewhat indistinctly depicted digestive tract is in the basal part of the zooecium. Only a part of the autozoid at left is shown. The scale directly above the setigerous collar applies to this figure.

FIGURE 17. A folded setigerous collar showing typical twisting of the supporting ribs or setae. The transparent membrane is faintly indicated at the distal end. Drawn to the scale directly below.

FIGURE 18. A young autozoid is shown at left. Only a part of the right one is included. The young polypide has eight tentacles and a U-shaped digestive tract. The setigerous collar is not visible but its Anlage (SC) is present. The vestibule (V) and the parieto-vaginal muscles (PVM) are plain. Line N represents the length of the peduncle which bears the autozoid. Measurements of it are given in Table I. Drawn to the same scale as Figure 13, on Aug. 13, 1944, from fresh material.

FIGURE 19. Three of the four chitinized gizzard sconces. The teeth are darker than the rest of the disc in this particular case. Muscle fibers encircle the cluster of four sconces and are here indicated by horizontal or parallel lines. Drawn to the scale at left.

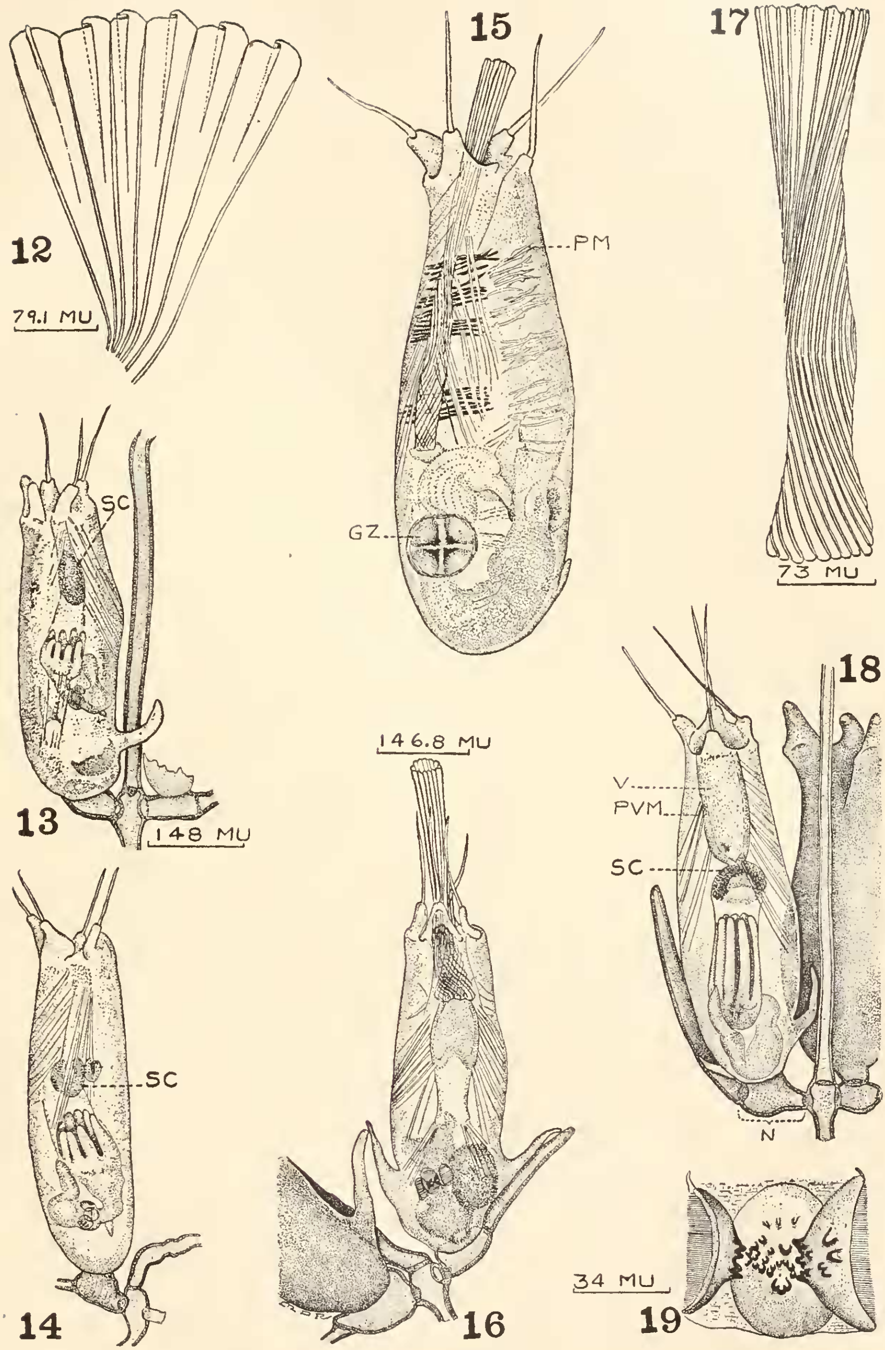
12
79.1 MU
15
PM
GZ
17
73 MU
13
SC
148 MU
18
V
PVM
SC
N
146.8 MU
14
SC
16
34 MU
19

PLATE II

in Figure 9. They are not upright but are recumbent at an angle close to the substratum. The basal part rests directly on the substratum, or is very close to it, while the distal part is free. The autozoids are somewhat elongate ovate with the broad end attached. The side nearest the substratum and the inter-autozoidal stolon is slightly flatter than the opposite side. At its point of origin the autozoid may be globose as in Figure 14 or slightly "stemmed" as in the right-hand individual of Figure 18.

The lower half of the autozoid is swollen slightly. From it arise from one to four, usually two, acuminate clasping processes (Figs. 7 and 16), which were called "tubular adherent processes" by Hincks (1887, p. 128) and "spines" by Harmer (1915, p. 87). They are placed obliquely on the zoid. They may touch the stolons or the neighboring autozoid or else cling to the substratum without touching either the adjacent autozoid or the stolon. Colonies in place on hydroids show some of these clasping processes curling around the hydroid stems, closely adherent. These clasping processes are hollow and not separated by any sort of septum from the rest of the zoid.

Hincks (1887, p. 127) described a large aperture closed by a membranous wall on the greater part of the ventral side of the autozoid. It is difficult to see in the Massachusetts specimens although indications of it are present in Figures 7 and 8. In Figure 7, it is evident on the second and fourth autozoids from the top. Moreover, it appears chitinized rather than membranous.

The distal tapering end of the autozoid has four spine-bearing processes (basal segments or flaps). Occasionally more than four flaps may occur. Harmer (1915, p. 88) reported a specimen with eight. This condition however is very infrequent. These flaps are arranged around the zooecial orifice through which the setigerous collar may be protruded.

The position of these distal triangular flaps is not rigidly, immovably fixed. The line of bending is at the base of the triangle. Sometimes the flaps may be flexed inward so that their spines may cross each other above the orifice as in the top left-hand zoid of Figure 9, or in Figure 16. This is the usual position when the setigerous collar is withdrawn into the autozoid. When the setigerous collar is out the flaps are bent outward as in Figure 6. This is the condition also in many empty zooecia. Whether there are any muscle fibers controlling the movement of these flaps was impossible to determine from the material at hand.

The flaps are more heavily chitinized than the surrounding zooecial wall. The difference is quite noticeable.

The apex of a triangular flap is rounded in all views. A sharply tapering, slightly irregular orificial spine is set shallowly into this rounded area. The spine is hollow, but so far as it is possible to determine its cavity is not continuous with the cavity of the flap but is cut off by a septum. In Porto Rican specimens the spines measured 0.20–0.30 mm. (Osburn, 1940, p. 343). Measurements of Massachusetts specimens are given in Table I.

The setigerous collar is long and very slender when furled. Harmer (1915, p. 88) gives its length as 0.46 mm. and its breadth at the distal end as 0.130 mm. This last figure is undoubtedly of a partly furled individual. The dimensions of the Massachusetts specimens are included in Table I.

The setigerous collar can be protruded clear out of the autozoid (Fig. 6). On the other hand, it also can be completely withdrawn into the autozoid. In fact it can be pulled in so far that its uppermost or distal tip is halfway down inside the zoid. There are muscular fibers attached to its base (Fig. 11). When it is completely withdrawn the tentacles are below it. When it is protruded and expanded the tentacles are within its circle of setae (Fig. 6).

Hincks (Pl. XII, Fig. 13), Harmer (Pl. V, Fig. 9), Marcus (1937, Pl. XXIX, Fig. 76) and the present writer (Figs. 6, 11, 15, and 17) have pictured the peculiar spiral twisting of the setae of the collar. The setae reinforce a delicate, colorless, transparent membrane which folds neatly like a fan along scarcely discernible creases between adjacent setae, when the collar is being withdrawn (Figs. 6, 12, and 17). The setae or ribs supporting the collar are extremely regular in diameter from base almost to the very tip.

The collar is often found in excellent condition even when all the zoid contents except the zooecial wall have disintegrated.

In young zoids as represented in Figures 13, 14, and 18 the setigerous collar is not yet completed but is represented by a mass of germinative tissue, SC, which temporarily forms a flexible canopy above the tentacles, at the bottom of the vestibule.

The vestibule is the cavity down which the setigerous collar travels when being withdrawn. Its wall is formed by a soft vestibular membrane, to which are attached a number of fibers which constitute the parieto-vaginal muscles. The vestibular membrane is shown withdrawn or introverted in Figure 18 and extruded in Figure 6.

The circular lophophore bears eight tentacles (Figs. 6, 13, and 14). This number is in agreement with the statements of Harmer and Marcus.

The tentacles, when retracted, are pulled into the introverted tentacular sheath in a manner characteristic of the Bryozoa (please compare Figs. 6 and 18).

They surround the entrance to the digestive system which is a U-shaped tract consisting of pharynx, esophagus, proventriculus, stomach and intestine. The most interesting features about the tract are the great length of the esophagus and the presence of a muscular and chitinized proventriculus or gizzard between the stomach and esophagus.

The proventriculi of various species of *Buskia* or *Aeverrillia* are illustrated in papers by Osburn and Veth (1922, Plate I) and Marcus (1941, Plate X, Figs. 44B and 45). Marcus figures the gizzard of both *A. armata* and *A. setigera*. However, the proventriculus of the Massachusetts specimens of *A. setigera* resembles that of his *A. armata* as much as it does that of his *A. setigera*.

The proventriculus of the Massachusetts *A. setigera* is a compact, rounded organ consisting of four conical chitinous sconces capping the internal epithelium. A wide band of circular muscle fibers surrounds these four sconces (Fig. 19). An end view of the proventriculus showing the relation of the four sconces to each other is pictured clearly in Figure 15 and suggested in Figures 9 and 18. A side view, showing the relation of the circular musculature to the sconces and the relative position of the proventriculus in the polypide, is depicted in Figures 13, 14, and 16. A detailed picture of the arrangement of the chitinous and sometimes brown-colored denticles on the sconces appears in Figures 1, 3, 4, 5, and 19. The denticles seem to have a definite arrangement in several roughly V-shaped rows. They are of various sizes. Their color ranges from pale yellow to brown. The shape of each sconce at the base ranges from a broad ellipse to a circle. In side view the sconce may appear globose, conical, or even slightly flattened, except for the projecting teeth. Careful inspection of an old or empty colony may occasionally reveal sconces of degenerated polypides still within the otherwise empty zooecia. Because the sconces are usually transparent, pale yellow, and small it is easy to overlook them. In degenerating polypides the gizzard can usually be distinguished as the central part of a dark mass of degenerating material.

The relations of the stomach and intestine to the gizzard and to the lophophore can be seen in Figures 13, 14, and 18. In these three instances the digestive tract is empty. In a mature feeding individual the digestive tract is considerably longer, as a study of Figure 15 will show. The intestine opens outside the circle of tentacles—a characteristic of the Ectoprocta.

The musculature of the lower half of the autozoid was difficult to study partly for lack of sufficient living material and partly because in a mature zoid the digestive tract occupies so much of the interior. However Figure 13 does show a suggestion of a band of retractor muscle fibers attached to the base of the tentaculer crown or the upper part of the digestive tract.

The other major muscles attaching to the body wall are the horizontally or circularly arranged parietal muscles. Harmer (1915 p. 88) states that three groups of parietal muscles are visible in his specimens. In the Massachusetts specimens it appears as if there are four groups (Fig. 15).

In a few near-empty zooecia, from which the musculature, tentacles, setigerous collar, and digestive tract were missing but which had a brown body (a mass of dedifferentiating or degenerating tissue) in the upper half of the zooecium, was noticed a rather peculiar globular membranous sac attached to the base of the interior of the autozoid, in the vicinity of the septum which separates the autozoid from the peduncle. This globose mass was hollow. Its wall was soft membranous, and turgid. It is not figured here. Its appearance and position suggest one of two possibilities: 1, it may be a regenerating mass which would give rise to a new polypide within the old zooecium; or 2, it may represent the remains of a degenerating polypide, exclusive of the brown body which was already evident in the upper half of the zooecium. In the fresh water Bryozoa, when polypides of a colony degenerate, sometimes the wall of the colony forms a hollow membranous sac which may either degenerate completely or give rise to a new colony (Rogick, 1938; p. 197).

In studying any form, measurements are extremely helpful. Therefore, as complete a set of measurements of *A. setigera* as was possible was made and is arranged in Table I. The letters and parts A to P are clearly indicated in the drawings of Plates I or II.

Discussion

Aeverrillia setigera seems very widely distributed circumtropically. It has been reported previously from such widely scattered localities as north and east of Australia, China Sea, Gulf of Bengal, Malay Archipelago, Suez Canal, Porto Rico, Brazil's Bay of Santos, etc., whose latitudes range from approximately 24° S to 31° N. The present report extends its range to 41°38′ N. Latitude. A recent report (Hutchins, 1945; from Long Island Sound) cites its occurrence slightly south of the present paper. In spite of this extensive range the number of reports on the occurrence of this species have not been too numerous: Harmer, Hastings, Hincks, Hutchins, Kirkpatrick, Livingstone, Marcus, Osburn, Thornely, and the present writer.

The Massachusetts specimens agree essentially in measurements and appearance with those found in more southerly waters (Gulf of Bengal, South America, and Porto Rico) by previous workers.

Because of their small size and inconspicuous appearance they are easily overlooked when collecting. Very little is known of their behavior, embryology, life history, and physiology. A study should be made of these as well as of colony degeneration, regeneration, rate of growth, development of the proventriculus and setigerous collar, the location and development of the reproductive system, and the nature of the larva. All the work done so far on this form has been of taxonomic nature. The present paper has added a more complete account of the anatomy, included measurements of a number of parts hitherto unmeasured and added a more complete series of diagrams than have existed previously for this species.

Summary

1. *Aeverrillia setigera* was found at Woods Hole and at New Bedford, Mass. This extends its northerly range to 41°38′ N. Latitude.

2. The Massachusetts specimens agree closely in appearance and measurements with specimens from more southerly waters of the Gulf of Bengal, Malay Archipelago, South America, and Porto Rico.

3. Measurements of many structures or parts not measured by other workers are here included.

4. The species has been more fully illustrated.

5. The species did not seem to be abundant in the localities from which it has just been reported.

LITERATURE CITED

Bassler, R. S., 1935. Fossilium Catalogus. I. Animalia, pars **67**: Bryozoa. *'s-Gravenhage.* p. 1–229.

Harmer, S. F., 1915. The Polyzoa of the Siboga Expedition, Part 1. The Entoprocta, Ctenostomata and Cyclostomata. *Siboga-Expeditie, Mongr. 28a, Livr.* **75**: 1–180; Pl. 1–12.

Hastings, A. B., 1927. Report on the Polyzoa of the Suez Canal. *Trans. Zool. Soc. London,* **22** (pt. 3, no. 8): 331–354.

Hastings, A. B., 1932. The Polyzoa, with a note on an associated hydroid. *Great Barrier Reef Exped. 1928–29, Sci. Reports,* **4** (12): 399–458, Pl. 1. *Brit. Mus. Nat. Hist.*

Hincks, T., 1887. On the Polyzoa and Hydroida of the Mergui Archipelago collected . . . by Dr. J. Anderson. *Jour. Linn. Soc. Zool.,* **21**: 121–135; Pl. 12.

Hutchins, L. W., 1945. An annotated check-list of the salt-water Bryozoa of Long Island Sound. *Trans. Conn. Acad. Arts and Sci.,* **36**: 533–551.

Kirkpatrick, R., 1890a. Hydroida and Polyzoa. Reports on the Collection made in Torres Straits by Prof. A. C. Haddon 1888–1889. *Sci. Proc. R. Dublin Soc., n.s.,* **6**: 603–625; Pl. 14–17.

Kirkpatrick, R., 1890b. Report upon the Hydrozoa and Polyzoa collected by P. W. Bassett-Smith . . . during the survey of the Tizard and Macclesfield Banks in the China Sea, by H.M.S. "Rambler." *Ann. Mag. Nat. Hist., ser. 6,* **5**: 11–24; Pl. 3–5.

Livingstone, A., 1927. Studies on Australian Bryozoa, No. 5. A checklist of the marine Bryozoa of Queensland. *Rec. Austral. Mus.,* **16** (1): 50–69.

Marcus, E., 1937. Bryozoarios marinhos brasileiros, I. *Univ. São Paulo, Bol. Faculd. Filos., Ciênc. e Letr., I. Zool.,* **1**: 3–224; Pl. 1–29.

MARCUS, E., 1938. Bryozoarios marinhos brasileiros, II. *Univ. São Paulo, Bol. Faculd. Filos., Ciênc. e Letr., IV. Zool.,* **2**: 1–196; Pl. 1–29.

MARCUS, E., 1939. Briozoarios marinhos Brasileiros. III. *Univ. São Paulo, Bol. Faculd. Filos., Ciênc. e Letr., XIII. Zool.,* **3**: 111–354; Pl. 5–31.

MARCUS, E., 1941. Sôbre os Briozoa do Brasil. *Univ. São Paulo, Bol. Faculd. Filos., Ciênc. e Letr., XXII. Zool.,* **5**: 3–208; Pl. 1–18.

OSBURN, R. C., 1933. Bryozoa of the Mount Desert Region. *Biol. Surv. Mt. Desert Region,* Part **5**: 291–385; Pl. 1–15.

OSBURN, R. C., 1940. Bryozoa of Porto Rico with a résumé of the West Indian Bryozoan Fauna. *Sci. Surv. Porto Rico and the Virgin Islands,* **16** (3): 321–486; Pl. 1–9. *N. Y. Acad. Sci.*

OSBURN, R. C., AND R. M. VETH, 1922. A new type of Bryozoan gizzard, with remarks on the Genus *Buskia. Ohio Jour. Sci.,* **22** (6): 158–163.

ROGICK, M. D., 1938. Studies on Fresh Water Bryozoa. VII. On the viability of dried statoblasts of *Lophopodella carteri* var. *typica. Trans. Amer. Micr. Soc.,* **57** (2): 178–199.

THORNELY, L. R., 1905. Report on the Polyzoa . . . at Ceylon, in Herdman's *Rept. Ceylon Pearl Oyster Fish.,* vol. **4**, Supplement. Report, 26: 107–130.

THORNELY, L. R., 1916. Report on the Polyzoa collected at Okhamandal in Kattiawar in 1905–1906. Hornell, *Rept. Gov. Baroda Mar. Zool. Okhamandal,* Part **2**: 157–165.